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# PUPA DIGGING.

BY THE

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## ON PUPA DIGGING.

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SOME years since, a few remarks of mine on this subject were read before the Entomological Society. I imagined the matter to have excited little or no interest until I read, with, I trust, pardonable gratification, the following passage in an article addressed to the 'Intelligencer' (vol. i. p. 74):—"Most of your readers will recollect a paper on digging for pupæ, which gave such an impetus to that mode of collecting." On reading this paragraph I forthwith determined that I would, if spared, write a few additional observations for the pages of the 'Zoologist,' in the hope that its readers might thereby be persuaded, in however slight a degree, to apply themselves with zeal to the only method by which their favourite study can be pursued during the long and dreary months of winter and early spring. I am the more induced to take this step, from the fact that I not unfrequently receive communications from my entomological friends and correspondents, making grievous complaints of their want of success; some asking information as to the "*modus operandi*," *all* inquiring, "What is the cause of my want of success?" In reference to the first of these questions, some remarks will be found at the close of this paper; in regard to the second, "What is the cause of my failure?" I answer, Many causes doubtless combine to produce

this undesirable result, such as want of experience, a sticky and clayey soil, unfavourable (*i. e.* wet) weather, &c. But I have no hesitation in expressing my firm conviction that, in nine cases out of ten, want of *success* proceeds from want of *patience*. A meets B. "Have you heard," inquires A, "of C's wonderful success in pupa digging? He has taken *dodonæa*, *Chaonia*, *Fagi*, *ocularis*, and I don't know how many rare insects." "You don't say so," excitedly replies B; "how is it done?" "Oh!" replies A, "simply enough: take a common garden-trowel and a box lined with moss; dig at the roots of any good-sized tree, or tear off the moss, and the pupæ will tumble into your box *ad libitum*." Enthusiastic B rushes home, seizes a trowel, procures a box large enough to hold all the pupæ for miles round, and departs, buoyant with hope, upon his first pupa-digging excursion. "Let me see," he soliloquises, "what shall I do with my *surplus* pupæ? Ah! Mr. L. wants *trepida*; well, he shall have two: and, if I remember rightly, Mr. S., who sent me so many insects I did not possess, said he wanted *ridens*; therefore he shall have three." While thus meditating a majestic oak strikes his eye. "Lo!" he exclaims, "the very tree for both species!" Nervously, yet firmly, he grasps the trowel, and approaches the unconscious tree. Forthwith the trowel is inserted half a foot into the earth, and, by a prodigious muscular effort, a gigantic sod is turned up. Eagerly he gloats over and peers into the sod lying before him: nothing meets his eye but a writhing worm and a wriggling centipede. "Why, how is this?—here's *nothing*!" With crushed hopes he is about to leave, when suddenly he remembers that he was directed to tap it gently, and then tear the roots asunder. The sod is tapped: an earwig! The sod is discerpted: a woodlouse! Perspiring with

his exertions, with aching back, he rises from his knees, looking rather foolish. (N.B. The digger's feelings at this crisis are often additionally lacerated by a small mob of boys looking on with gaping mouths). He rises, I repeat, from his knees, takes up his huge box, and goes to a poplar: the same process, the same result. Then to a birch: ditto, ditto. This is too much! Angry and disappointed, he hastens home, seizes a sheet of paper, and writes off to the author of "that paper" on pupa digging, to ask, "What is the cause of my want of success?" Partly, my friend, ignorance of the proper method of setting to work, but, much more, the want of patience and perseverance. I know nothing which requires a more constant and vigorous exercise of these virtues than pupa digging. A *total* want of success is undoubtedly disheartening; and accordingly, in the hope of encouraging despondent "diggers," I now append a list of insects, all of which have been taken by me in this way. Having this object in view, the commonest species are included, with a description of the tree, locality, time of appearance, &c. While this may prove uninteresting to the experienced, it will, I trust, be instructive to the beginner, for whom I write. Where no other locality is mentioned, Suffolk is intended. As there appears to be a *biennial* change in our nomenclature, I have thought it best to adopt, as most generally known and used, Doubleday's 'Synonymic List.'

*Thecla Rubi.* A pupa of this insect was once found under moss on a log of wood. Bucks.

*Satyrus Ægeria.* I have several times met with the pupa of this butterfly, suspended from blades of glass, when digging at the roots of trees. It is a beautiful grass-green colour, and passes the winter in that state.

*Ægeria apiformis.* Vide 'Intelligencer,' p. 18. This insect, though I have not seen it on the wing, seems to swarm

here, judging from the number of pupa-cases in the trunks of poplars.

*Smerinthus Tiliæ*. Found commonly. Birch and elm. Prefers the narrow angles formed by the roots, getting in as far as possible. October, &c.

*Smerinthus Populi*. Common. Various poplars: edges rather than the angles. October, &c.

*Smerinthus ocellatus*. Scarce. Willows. October, &c.

*Euchelia Jacobææ*. This insect is, I believe, considered very common, yet I never took more than one specimen in England: far otherwise, however, in Ireland, where it abounds, and I have taken the pupæ in boundless profusion under loose bark on wych elms; of course the larvæ must have crawled up the trunks to form their cocoons, as they feed on the ragwort. I think it must be *local*, as that plant is very common here, yet I have not seen the insect.

*Lithosia rubricollis*. In abundance under damp moss, decayed bark, &c. Chrysalis short and stout, enclosed in a delicate white web. Should be occasionally damped. Fir, larch, oak, &c. October, &c.

*Lithosia quadra*. Occasionally. Spun up on palings, in the neighbourhood of trees covered with lichens. End of June.

*Lithosia griseola*. May be found under moss on lichen-bearing trees. June.

*Phragmatobia lubricipeda* and *Menthrastris*. Common. Spun up in loose rubbish collected about the roots of various trees. October, &c.

*Phragmatobia mendica*. Rarely. Under moss on trees bordering damp ditches. Gloucestershire. October, &c.

*Liparis monacha*. This singular chrysalis may be found by examining the trunks of oaks, in the crevices of the bark of which tree it spins up. End of July.

*Orgyia pudibunda*. The conspicuous yellow cocoon of this species is easily detected among loose rubbish collected about the roots of trees; sometimes under loose bark. The larva is polyphagous, and consequently the pupa may be found at various trees. October, &c.

*Orgyia Coryli*. Very plentifully under moss on beech: generally at the roots, and not on the trunk. October, &c. Bucks.

*Eriogaster lanestris*. I was much surprised at finding two pupæ of this pretty insect, the other day, at the roots of an elm. I thought it was exclusively a hawthorn-feeder, but there was no hawthorn at all near at hand. October, &c.

*Trichiura Cratagi*. The compact egg-shaped cocoon of this species I have once or twice met with at the roots of poplar, the larva having probably wandered from some neighbouring hawthorn. July.

*Pæcilocampa Populi*. This insect is found in various situations, and on various trees,—ash, poplar, &c.: sometimes it will be found firmly glued to the inside of a piece of loose bark or to the tree itself; at others spun up tightly among decayed leaves, dead grass, &c. It ought to be among the early captures of the pupa digger, as it is common, and not difficult to find. The cocoon is black. August and September.

*Platypteryx falcula*. Where birch is common examine the leaves joined together, and you will not unfrequently find the pupa of this species. June, and again in September, &c.

*Platypteryx unguicula*. Substituting beech for birch, the same remarks apply to this as to the preceding.

*Cerura furcula*. Under bark and on trunks of willow, occasionally. September, &c.

*Cerura bifida*. Occasionally on trunks and under bark of poplars. September, &c.

*Cerura vinula*. On trunks of poplar and willow. September, &c.

In regard to the two first of these insects, the best way, I think, to find them, is to draw the finger slowly down the trunk, and carefully to examine the line thus formed, and about an inch on each side of it; they will generally be found at distances varying from one to three feet from the ground. You will almost invariably find *vinula* close to the ground.

*Stauropus Fagi*. Once found between two decayed beech leaves. Halton, Bucks. October.

*Petasia cassinea*. One female at roots of elm. July. Gloucestershire.

*Ptilodontis palpina*. Occasionally at poplars, but much more frequently at willows, especially when on the banks of ditches, streams, &c. When in such situations, that side of the trunk which faces the stream is often clothed with grassy sods of loose, dry, friable earth: this is the place for *palpina*.

Shake the sod well, and the cocoon, which is grayish and of weak consistency, will generally be found among the dry roots: it is easily distinguishable from that of *dictæa*, being much smaller,—*i. e.* the cocoon,—and not so much mixed up with earth. End of September.

*Notodonta camelina*. Very common under moss on various trees,—beech, elm, &c. A little experience will soon enable the beginner to detect it. The pupa is enclosed in a weak cocoon, and, unlike the other species in this genus, terminates in a single point or spike. October, &c.

*Notodonta cucullina*. Once found under moss on a beech tree, having doubtless wandered from some neighbouring maple. October. Halton, Bucks.

*Notodonta dictæa*. See remarks on *palpina*. This species forms a large cocoon, sometimes nearly the size of *trepida*.

*Notodonta dictæoides*. I have found the empty pupa-cases of this species at the roots of birch? I put a note of interrogation, as, having never bred it, I am not sure.

*Notodonta dromedarius*. The only pupæ of this insect I ever found were in Ireland: they were all, nine in number, taken at the roots of an alder, and produced the variety commonly known, I believe, by the name of *perfusca*. They seem to me very different from the English specimens of *dromedarius*. October.

*Notodonta ziczac*. Rarely, at roots of poplar. October, &c.

*Notodonta trepida*. This autumn I have succeeded in taking no less than seventeen of this fine insect. It appears to prefer a sandy soil, and does not seem so partial to *corners* as others of this genus. Oak. September, &c.

*Notodonta dodonæa*. During the present and preceding autumns I have taken upwards of 300 pupæ of this species, mixed with *Chaonia*, which is much rarer here, and goes down a full month earlier. Search as usual the dry, friable sods collected in the corners, or the corners themselves without any sod. The cocoon is sometimes attached to the tree, but more usually among the roots: in either case great caution is necessary. It is a good plan, when you have pulled the sod out, to put your hand in and gently feel the trunk for any cocoons which may adhere to it. It is not easy to tell the difference between *dodonæa* and *Chaonia*; but the latter is, I think,



stouter, smoother, and not so glossy. Oak. September, October, &c.

*Pygæra bucephala*. Various trees. October, &c.

*Clostera curtula*. Seven. It is well worthy of notice, in regard to this species, that the larva enters the pupa state *on* the tree; I had imagined that it did so among *dead* leaves: this is not the case, at least not necessarily. When full-fed it joins two leaves firmly together, and remains there till they fall off. I was not aware of this fact till the present autumn. This hint may, I hope, enable others to obtain this apparently much-prized insect. I should add that they had not *turned* when I found them; but they never came out of the leaves. Various poplars (shrubs, best). October.

*Semaphora Psi*. Common under bark on various trees. October, &c.

*Semaphora tridens*. I have little doubt that the pupa I am in the habit of taking under bark on hawthorns is this species; but, as Psi also feeds on that tree, and it appears impossible to separate the two species, except by breeding them, I am unwilling to speak positively. October, &c.

*Acronycta megacephala*. By no means uncommon under loose bark on poplars; occasionally on willows. It is not very easy to get at, as it enters into the smallest chinks. Break off every bit of loose bark with the point of the trowel, and the pupa-case, which, with the pupa, closely resembles that of Psi, will be found firmly glued to the surface. The cocoon is formed of decayed wood. October, &c.

*Acronycta Aceris*. Five; all on *oak*, not sycamore. October, &c.

*Acronycta Ligustri*. Abundant under moss on ash trees. The moss must be *very* carefully torn off: the pupa-case, which is black and very tough, not *hard*, will, in most cases, be found adhering to the moss. If there be no moss, examine the trunk. There are often long perpendicular slits in the bark of ash trees, and this is a favourite hybernaculum for Ligustri. If both moss and loose bark are wanting, go to another tree. October, &c.

*Ceropacha Or*. Very rarely under moss and dry rubbish on and about poplars. October, &c. Gloucestershire.

*Ceropacha ocularis*. Of this rare and beautiful species I took, last autumn, four; up to the present time I have taken

nine more, four being unfortunately stung. The pupa is black and stout (something like *Coryli*), enclosed in an extremely delicate open net-work of a rusty brown colour; it is very difficult to find; it frequently, nay, generally, spins on the surface of spreading moss, or barely beneath it,—sometimes between two leaves; in this latter case it is soon blown away, and, in the former, falls an easy prey to the first prowling mouse. It should, therefore, be sought for as soon as possible after the change: this, I think, should certainly not be later than the first week in October. Various poplars.

*Ceropacha ridens*. Of this also rare and very beautiful insect I took twenty-six last autumn; up to the present time I have only found seven. Like the last species, it is extremely difficult to find, and should be sought for as soon as possible, *viz.* middle and end of August.\* The following directions may enable others to find it:—Detached oaks growing in meadows, of a dry, loamy soil, seem the best; the situation evidently preferred is the corners filled with dry rubbish and little stunted brambles. Insert the trowel well into the earth, six or seven inches from the *angle*, and turn up the sod, bramble and all, if possible. To find the pupa, after this is done, is a work both of time and pain. It will not do, in this case, to *tap* the sod. First carefully examine the dead leaves, for they frequently spin up in them; you must then, regardless of scratches, tear the roots asunder as gently as possible. The cocoon is very weak, composed of little bits of stick, dried leaves, &c., and requires delicate handling; indeed, the whole concern demands an elaborate manipulation. This is one of those pupæ to find which exacts a large exercise of the two virtues already alluded to. (N.B. Pupa diggers wearing *gloves* will return home with empty boxes). Oak.

*Apamea unanimitis*. The hibernating larvæ of this species may be commonly found under loose bark on willows growing near damp ditches, in April. When you return home, place

\* I take this opportunity of correcting a mistake in the 'Manual' respecting the larva of this species and that of *flavicornis*. In that work they (the larvæ) are said to be found in *September*. This is a strange error. *Flavicornis* is one of the earliest *spring* feeders, while *ridens* is found a little later in the season. I have taken the *pupa* of this latter, as stated above, in the middle of August; and, without any question, there is but *one* brood of both these species.

them in a box with a little earth and moss, and, without further care on your part, the perfect insect will appear in June.

*Xylophasia hepatica* and *rurea*. Like the last-named, I have found the larvæ (full-fed) of both these species, in April, under damp moss on stumps of trees, &c.: they require no attention. *Hepatica* I have generally found under damp moss on poplars.

*Segetia xanthographa*. This much-abused, yet, when bred, pretty insect, may be found at the roots of most trees. End of July, August.

*Noctua C-nigrum* and *festiva*. Occasionally at roots of trees. July.

*Chersotis plecta*. Very common at the roots of various trees. October, &c.

*Agrotis putris*. Very common at the roots of various trees. October, &c.

*Tæniocampa stabilis*, *instabilis*, *gothica*, *cruda*. Extremely abundant at the roots of various trees. October, &c.

*Tæniocampa munda*. A few at roots of oak. Gloucestershire. October, &c.

*Tæniocampa populeti*. Of this rare species I once found a "nest" of thirteen at the roots of a poplar. It goes much deeper into the earth than most other insects. Bucks.

The last eight species may easily be found by simply shaking the sod or loosening the earth; and by taking a large number (I once had 1000 pupæ of *instabilis*) of the common species some curious and beautiful varieties may be obtained without trouble.

*Orthosia Upsilon*. The larva of this species may be found in profusion under loose moss and bark on willows and poplars, but they must be fed. Beginning of June.

*Orthosia macilenta*. Of this species, so difficult to obtain in good condition, when in the perfect state, I have found only three. The chrysalis, which is extremely delicate, is enclosed in a weak cocoon. Birch September.

*Cosmia diffinis*. Not uncommon where elms abound. Spins up close to the trunk. End of July. Bucks.

*Cirrædia xerampelina*. Of this rare species I took forty-seven last year; this year I have only met with eight. It is perhaps the most difficult of all pupæ to find, and, when found, the most liable to be injured. The following directions may

be found useful:—They are to be sought for at roots of ash: trees of a good growth need only be tried; those on the borders of streams and damp ditches will be found most productive. This insect forms a hard, egg-shaped cocoon. Turn up the loose, dry earth, rubbish or moss about or adhering to that side of the tree which faces the stream; crumble it *very* carefully with the hand. Should you see something resembling a cocoon, of a dark, muddy colour, take it up and try whether you have obtained a prize; but in this trying lies the danger: though hard, the cocoon is extremely *brittle*, and almost the slightest pressure crushes it; the best way, therefore, when you think you have a cocoon, is to pare one end with a pen-knife as gently as possible. If, after scraping it in this manner, you find it is a cocoon, you have found xerampelina, and may congratulate yourself. You may look for it as early as the beginning of August, certainly not later than the first week of September. I may add that Mr. Doubleday informs me that the larva feeds on the seeds of ash trees.

*Xanthia ferruginea*, *aurago* and *citrago*. I have found all these species, though rarely, at roots of lime trees. August. Bucks.

*Chariptera aprilina*. In the utmost profusion. I have taken as many as twenty at one tree. This will be one of the first pupæ found by the beginner: nothing can be easier: merely turn up the earth and break it, and they will tumble out of their brittle cocoons in plenty. Oak. July and August.

*Hadena Persicariæ*. Common under moss on various trees. October, &c.

*Hadena protea*. Not uncommon at roots of oak. Cocoon greatly resembles that of xerampelina. July and August.

*Hadena Pisi* and *thalassina*. May occasionally be found under moss, stones, stumps, &c., on or about heaths. October, &c.

*Heliothis marginata*. Once found, but I cannot say where.

*Abrostola triplasia* and *Urticæ*. They may both be found, though not commonly, under moss on ash trees throughout the autumn.

*Catocala nupta*. This fine chrysalis occurs not unfrequently under loose bark on willows. It never enters the earth, as far as my experience goes. August.

*Botys urticalis*. This is the only *Pyrallis* of which I ever found the pupa, and, strictly speaking, not even of that, since it was the hybernating larva. It (the larva) may frequently be found enclosed in a comfortable cocoon under the bark of most trees. I shall not soon forget my disappointment when the perfect insect made its appearance.

*Geometra papilionaria*. At roots of oak. Beginning of July.

*Eurymene dolabraria*. This beautiful insect I used to take in plenty under moss on beech trees in Bucks; it occurs also, but much more sparingly, on oak. The larva enters the moss at the first convenient place, and therefore in tearing it off (which should be done with the *hand*, not the trowel) great care must be taken in loosening the *edge* of the moss, for *there* the pupa is, I may say, invariably found. October, &c.

*Ennomos illunaria*. I once found, as stated in my first paper, a whole brood of this species at the roots of one ash tree. Not met with since. September.

*Ennomos fuscantaria*. Once found spun up at the roots of an ash. August. Brandeston.

*Ennomos tiliaria*. Two or three spun up between blades of grass growing in the corners formed by the roots. Birch. August.

*Odontoptera bidentaria*. Common under moss everywhere. October, &c.

*Crocallis elinguaris*. The pupæ of this species may be taken in comparative plenty under moss on poplars about the end of June or beginning of July.

*Anisopteryx æscularia*. Not uncommon at roots of elm and oak. October, &c.

*Hibernia leucophæaria*. One female at roots of, I think, a sycamore.

*Hibernia rupicapraria* and *progemma*. Very common at roots of elm throughout summer and autumn.

*Hibernia aurantiaria* and *defoliaria*. Also common in the same situations. Should be looked for not later than September.

The above four species may be found in little "clusters" in dry nooks formed by the roots of elm trees, and beautiful varieties thus procured. Much trouble in looking for the apterous females will also be saved.

*Phigalia pilosaria*. Common at roots of elm. October, &c.

*Biston hirtaria*. Common at roots of ash. This pupa may be known by a row of dull yellow spots on each side. In October, &c.

*Biston prodromaria* and *Betularia*. Both common; the former at roots of oak, the latter at those of elm. October, &c.

*Boarmia abietaria*. Found in profusion at roots of fir trees in Gloucestershire. Last week in June: this time should be strictly adhered to, as the insect sometimes remains only eight days in the pupa state.

*Tephrosia laricaria*. Several, in the New Forest, under moss on oak trees. October, &c.

*Tephrosia consonaria*. This insect appears in the perfect state about the first week in May. The pupa should be looked for in April, under moss and at the roots of beech: it appears to be exclusively attached to that tree. Bucks.

*Harpalyce ruptaria*. Common at roots of elm and lime. The pupa is enclosed in a web-like cocoon, and is greenish yellow, powdered with brown spots. October, &c.

*Harpalyce russaria* and *immanaria*. Common at roots of willows.

*Ypsipetes elutaria*. In abundance at roots of willows. Most extraordinary varieties may be thus obtained. July.

*Ypsipetes impluviaria*. Common under moss on alders. October, &c.

*Ypsipetes ruberaria*. I once took about a dozen of this insect under loose bark on poplar. Bucks. April. The larva hibernates, I think; for, if I remember rightly, some had not turned when I found them in the spring.

The pupæ of the three last-named species are all black and very active.

*Phæsyle miaria*. Very common at roots of willows. August.

*Phæsyle Psittacaria*. Much rarer. Birch and sycamore.

The pupæ of both these species (together with that of *Epione apiciaria*, which I forgot to mention in its right place) may be found spun up in loose grass, or attached to the trunk: the latter species at willow. The pupæ of all three have a purple bloom, and I cannot see any difference between them.

*Ckeimatobia dilutaria* and *brumaria*. These two common insects may be found in the utmost profusion at the roots of almost any tree throughout the summer. There appears to be an impression on the minds of some that autumnaria and filigrammaria are only varieties of these species. Of course the best way to decide the question is by breeding them: this I have not done; but out of many hundred pupæ of dilutaria I have never had anything like either of them. I am aware that up to this time they have only been taken in Scotland, or, at any rate, in the North. As I have had no digging in either of those localities, the above fact may be thought of little value. I would venture to recommend the northern collectors to dig at the roots of *elm* and oak any time during the summer, and to collect as many pupæ as possible. (N.B. I suppose every one knows the pupa of dilutaria). Should the three insects, or two of them, be or not be produced from these pupæ, it would, I think, assist considerably in solving the question. In my opinion all three are abundantly distinct.

*Eupithecia exiguaria*. Occasionally under bark on hawthorn. October, &c.

*Eupithecia abbreviaria*. Occasionally under bark on oak. October, &c.

*Eupithecia castigaria*. Occasionally under bark on hawthorn. October, &c.

*Eupithecia innotaria*. Of this rare species I have been fortunate enough, at different times, to take seven. I believe the food of the larva is not ascertained, but I have little doubt that it feeds on ash, as all my pupæ were taken under moss on that tree. To find it, see directions under the head of *Eurymene dolabraria*. October, &c.

*Eupithecia dodonæaria* (*subumbraria*, Doub. List.) This very pretty insect I am in the habit of taking under loose bark on hawthorns throughout the winter and spring. It is enclosed in a delicate web.

#### REMARKS.

1. The above list, it will be seen, comprises no less than 113 insects, including many of the rarer species. It might

have been considerably increased by adding others, which may occasionally be found in digging gardens, stubbing up roots, turning sods of grass, &c.; but as no fixed rules can be laid down in reference to these methods, or, to speak more correctly, since I can give none, I have confined myself strictly to *trees*, on or about which all the above may be found by assiduous collectors.

2. An examination of the list will show at once that the following trees are the most productive, *viz.*, poplar, willow, oak, elm, birch, beech, ash and hawthorn. But *all* trees should be tried. Knock off the loose bark and loosen the moss on every tree you pass. I do not think there is much use in digging at the roots of any trees, except those mentioned, unless a particular insect be wanted, such as *Boarmia abietaria* or *Trachea piniperda*, at roots of fir, &c., &c.

3. It will also be seen, by referring to the list, that in a very large majority of instances September and October are quoted as the best time for searching; and this is undoubtedly the case. From whatever cause or causes, such as mice, damp, mould, earwigs, &c. (I have *seen* earwigs eating a soft pupa), chrysalides become scarcer and scarcer as the season advances, meaning by the term *season* winter and spring. If the collector, therefore, wants any particular species, obviously his best plan is to search for the pupa as soon as possible after the larva has gone down or spun up. Assuming that the collector knows the period when the insect he wants is feeding as a larva, and its probable or usual duration in that state, a little experience will soon enable him to know how soon he ought to dig for the pupa. A fortnight will generally be found ample time. Let us take *Notodonta dodonæa* as an example. The larva of this insect is full-fed about the 25th of August.



Allowing, then, a fortnight for the change, the collector should begin to dig about the second week in September; and during the ensuing three weeks of that month he will probably find more specimens than during the whole of the remainder of the season. Of course *all* the larvæ of the same species are not full-fed on the same *day*, many causes combining to produce some uncertainty in this respect; but, as a rule, the variation is not considerable. But though, for the above reason, the pupa digger should be unusually active in his exertions during September and October, let him by no means afterwards sink into inglorious ease, content to rest on his laurels. Pupæ may be found all the year round. I seldom let anything like a fine day pass without taking a good walk into the country, trowel in hand; and if I return home in January with only *two* pupæ, instead of the *eight* which I might very probably have taken in October, I am quite satisfied. Successful or unsuccessful, I can confidently recommend the *exercise* to the corpulent and obese.

## HINTS.

At the risk of appearing tedious, I append a few observations as to the method of digging, the best localities, &c. I am aware that these observations have, for the most part, appeared elsewhere; but, considering that this paper would be incomplete if they were entirely omitted, I must ask the indulgence for recapitulating some of them.

The only implements required are a common garden trowel and a small box filled with damp moss, for the purpose of carrying the pupæ, which should be handled as seldom as possible, and with the utmost tenderness. I may here remark

that the pupa digger must not be surprised or disheartened if some of his pupæ dry up. This is caused by some unlucky, probably *unseen*, injury, inflicted at the time of capture, and, however great his caution, will not unfrequently occur. But to return ;—With regard to localities, the best are unquestionably parks and meadows with *scattered* timber trees. Those trees from which the surrounding grass has been worn away by the feet of cattle, and those situated on the borders or banks of streams, dykes, &c., when the soil is dry and friable, will be found the most remunerative. When the pupa digger enters on new hunting-ground, let him endeavour to attain an eminence which commands a survey of the surrounding fields, &c. Having accomplished this, let him cast a scrutinizing glance around. Should a lofty oak or a stately poplar be seen rearing itself in *solitary* majesty in the middle of a field, let him rejoice ; and, having hastily descended from his not “bad” eminence, let him at once proceed to it, regardless of hedge and ditch. If there be a nice dry sod, ensconced in some snug corner, formed by the roots, he can scarcely fail of success. Insert the trowel, *in this instance*, about eight inches from the trunk, to the depth of four. Turn up the sod and lay it on the ground. Look then at that part of the trunk from which the sod has been removed, and, if you cannot see, feel gently with the hand for any cocoons which may adhere. Then take the sod in the left hand and tap it softly with the trowel, and the pupæ which form no cocoon, or a very weak one, such as *Aprilina*, *prodromaria*, &c., will drop out. If the sod be composed of very loose, dry earth, simply shake it. Lastly, tear the roots asunder for *Bombyces* ; if, however, the roots be strongly matted together there is little or no use in doing this. Before leaving the tree, see if there

be any nooks or crannies formed by loose bark, in which case break it off with the hand if possible; if, however, this cannot be done, wrench it off with the trowel, observing that it should not be inserted further than is *absolutely* necessary. It is astonishing into how small a hole or crevice a caterpillar will creep. If, therefore, an insect such as megacephala, which spins up under the bark, be wanted, these little nooks must be carefully and *cautiously* examined. If moss be on the trunk or roots, tear it gently off, and search both the moss and the trunk. When these operations are ended the tree may be looked upon as "done for." In digging *round* a tree, by which I mean one whose roots do not form any angles, it is not necessary to insert the trowel deeper into the earth than three inches, or further from the trunk than four. With regard to woods, I can add nothing to what appeared in my first paper, from which I make the following extract:—"It is in vain to examine the *dense* portions; it is equally vain to dig at the *roots* of trees in such localities, with few exceptions; and you will rarely find anything, unless upon trees of a considerable growth. The thick moss which collects about the trunk and roots is the part to be examined. 'Bombyces' are generally (almost invariably) found under the moss which covers the spreading roots, and not on the trunk. The best localities in woods are the borders and open places; and it is curious that such places, when elevated or facing the North, seem to be the most productive." Touching hedgerows, I must so far modify my former wholesale condemnation of them as to say that I found two pupæ of *ocularis* in such a situation this autumn. It should be borne in mind that in condemning hedgerows I condemn the *trees*, not the hedgerows. As Mr. Douglas justly remarks, in his highly interesting and instructive

little book, the 'World of Insects,' p. 116, "Pupæ must be there," *i. e.* in the *banks* on which the hedgerows are. I shall most thankfully receive any information as to the *modus operandi* in this case from those who have tried it. I imagine that Noctuæ, and not Bombyces, will generally be found in such situations. In the occasional records of insects taken in the pupa state I observe the frequent use of this expression, "Pupa, by *raking*." What is the meaning of the term "raking?"

There is no use in trying hard, sticky or clayey ground; but the following hint will be found valuable: always *replace* the sod when you have done with it, or at least the *débris*. When first taken up, the sod may be so hard as to render it impossible for the caterpillar to penetrate it; but if, after being loosened by the pupa digger's manipulation, it be restored to its place, the larva, which in the original instance would have wandered to some more convenient spot, will now find one ready made, and will almost certainly make use of it. This has been evidenced to me in the most unmistakable manner, in proof of which I may adduce the following example:—One day, last June twelvemonth, I came to a most unpromising-looking oak. Observing a little angle, I inserted the trowel, and found the soil as hard as a board; nevertheless, I turned up the sod, shook it, and, having found nothing, loosely replaced it. In the following September I returned to the same tree, and, having, unsuccessfully dug round it, came to my little (it was not more than three inches each way) sod, and raised it with anxious hand, when, lo! to my delight and astonishment, *five* pupæ of *Notodonta dodonæa*, all joined together in a little cluster! It is obvious that the above plan will be of no use during the winter months, but can only be

made available while the larvæ are feeding, *i. e.* in the late spring and early summer months. It will then be said, "You dig all the year round?" I answer, certainly: September and October are the most *productive* months, it is true; and August and September will be found the best time for the autumnal species; but that is no reason why the other months should be neglected. Of course I dig much more sparingly during the spring and summer, at which period insects may be taken in the larva and imago state; but I seldom go out without my trowel; and I can confidently recommend the collector in want of any particular tree-feeding Bombyx or Noctua to prepare a comfortable home for the larva, in the manner given above.

When the ground is very wet do not try *digging*. Rather examine moss, loose bark, &c.

With regard to the question, which will probably be asked by my readers, "Which are the most *likely* trees?" I answer that general directions on that head will be found scattered through the paper; and I would only add in this place that it appears to me useless to try any trees but those of considerable growth, and that when the trunks or roots of such trees are thickly matted with ivy no pupæ will be found. But the uncertainty on this point is truly extraordinary. In my first paper I gave an instance; I now subjoin another. In the neighbourhood of Brandeston is a park, belonging to the Duke of Hamilton, which is filled with fine old timber oaks, and is a grand hunting-ground for the pupa digger. On one occasion I came to a meadow adjoining this park, in which were about sixteen oaks, all fulfilling the necessary requisites for "likely" trees, old, filled with angles, and a dry soil. Out came the trowel, the box was prepared, and I began with number one.

I dug for about two hours; at the expiration of that time I looked into my box, and found the result to be three *instabilis*. There remained one tree, which did not seem to offer any advantages over the others; yet at that one tree, in a corner, about the size of a good large plate, edged with loose grass, I took the following, *viz.*, three *trepida*, *seventeen* *dodonæa*, three *prodromaria*, seven *hirtaria*, and two or three dozen *cruda*, *gothica*, *plecta*, &c. This is a simple *fact*, and in reference to it I would ask, "Can any one assign even a plausible reason for so singular a circumstance?" The same thing, though in a less degree, occurs every day, and seems to set at nought anything like fixed rules.

If this paper be of any use in enabling the collector to fill up some of the blanks in his cabinet with his own hands (and who would not rather do so with his own hands than with those of others?), I shall feel well repaid; and any letter addressed to me as below shall be willingly and promptly attended to, where further information may be desired.

That pupa digging is much on the increase I infer from several circumstances, among which I may mention the comparatively frequent record in the 'Intelligencer' of insects captured in this way. Surely the most desponding must be nerved to renewed efforts when he reads that *bicuspis*, *ilicifolia*, *fluctuosa* and *conspicillaris* (8) have rewarded the enthusiastic pupa digger. \*

In confirmation of the above opinion, I here give an extract

\* If this should meet the eye of Mr. Smith, will he be so obliging as to state when, where and how he obtained the pupa of the last-named insect?

from the letter of a highly-esteemed correspondent, Mr. Bree, of Stowmarket:—"I met some young boys, a day or two ago, digging round some trees. To my horror I found that they had read of the —— (modesty forbids my giving the adjective here added) Mr. Greene in the 'World of Insects,' and were exterminating all my game. They had got about a dozen under an elm tree!" I hope Mr. Douglas may be as much pleased with this circumstance as I was.

I hope it will be borne in mind by my readers' that the remarks, hints, &c., contained in this paper, are not intended as incontrovertible dogmas, but merely as the results of my own experience and observation.

And now I will conclude with one, literally *one*, word of advice to the incipient pupa digger, and it is this: PATIENCE!

JOSEPH GREENE.

Playford, Ipswich,  
November, 1856.

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